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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/941,760	08/30/2001	Philip J. Ireland	M4065.0143/P143-A	7179
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DICKSTEIN SHAPIRO LLP			DUDA, KATHLEEN	
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1756

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/941,760

Applicant(s)

IRELAND ET AL.

Examiner

Kathleen Duda

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 February 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 32,36,38-40,42,44-48,50,51,60,61 and 63 is/are pending in the application.
- 4a) Of the above claim(s) 51,60,61 and 63 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 32,36,38-40,42,44-48 and 50 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

1. Claims 32, 36, 38-40, 42, 44-48, 50, 51, 60, 61 and 63 are pending in this application.

Election/Restrictions

2. Applicant's election with traverse of Group I (claims 32, 36, 38, 39, 40, 42, 44-48 and 50 in the reply filed on February 1, 2006 is acknowledged. The traversal is on the ground(s) that the same search is required for all groups, the inventions are closely related and that there is a serious burden on the Applicant. This is not found persuasive because the same search is not required for an integrated circuit as a computer system, the inventions may be related in their use but the search for such inventions is diverse and there is a serious burden on the examiner to examine all of the claims.

The requirement is still deemed proper and is therefore made FINAL.

3. Claims 51, 60, 61 and 63 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected species, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on February 1, 2006.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 32, 36 and 38-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blatchford (US6200734) in view of Tanaka (US 5,733,712).

Blatchford discloses a method for fabricating semiconductor devices in integrated circuits using photolithography. The semiconductor device comprises substrate 10, field oxides 11 (dielectric) of varying topography, metal layer 18 (reflective), antireflection coating 17 and photoresist layer 16. The layer of metal will ultimately be patterned to gate electrodes when the MOSFET device is formed. The antireflection coating 17 comprises three layers 13, 14, 15 of silicon containing oxides such as silicon oxynitrides, each with different indices of refraction (n) and extinction coefficients or absorptions (k). The antireflection layers are used to eliminate the interference patterns caused by the rays reflected by the underlying topography when the photoresist is exposed (col.1, 18-col.2, 64). Antireflective coating 17 comprising 3 layers

with different indices of refraction n and extinction coefficients k are used to eliminate the problem of undesirable interference patterns (col.2, 8-32).

When there are three antireflection layers, the first antireflection layer 13 is formed with a thickness of 350-450 angstroms (35-45 nm), while the second antireflection layer 15 is formed with a thickness between 150-250 angstroms (15-25 nm). For the first antireflection layer, k_1 is between about 1.1-1.9 and for the second antireflection layer, k_2 is between about 0.15-0.3. The index of refraction n_2 is in the range of 1.7-2.0 (col.4, 49-61). In order to prevent crosslinking between the photoresist layer 16 and the antireflection coating 17, an additional oxynitride layer 19 (dielectric layer) is formed there between (col.3, 8-15).

Blatchford teaches that in general antireflection layers are used to eliminate the interference patterns caused by the rays reflected by the underlying topography when the photoresist is exposed and specifically that antireflective coating 17 comprises 3 layers with different indices of refraction n and extinction coefficients k in order to eliminate the problem of undesirable interference patterns. The reference however does not explicitly state that the amplitudes of the interfaces are approximately equal and that the phase differences of the reflected radiation from the interfaces mutually cancel when combined or that the phase differences are approximately 180 degrees out of phase. Tanaka teaches that the known antireflection method

utilizes light interference to prevent reflection and that it is known that the antireflection method using light interference requires that the reflectivity of the interfaces be equal and of the opposite phase in order to cancel the reflected light from these interfaces (col.1, 37-38, col.2, 1-9). Therefore one of ordinary skill in the art would have to expect that the amplitudes of the interfaces are approximately equal and that the phase differences of the reflected radiation from the interfaces mutually cancel when combined or that the phase differences are approximately 180 degrees out of phase in the method of Blatchford which uses three antireflective layers with different indices of refraction n and extinction coefficients k in order to eliminate the problem of undesirable interference patterns because Tanaka teaches that it is known that the antireflection method using light interference requires that the reflectivity of the interfaces be equal and of the opposite phase in order to cancel the reflected light from these interfaces.

Blatchford teaches that k_1 is between about 1.1-1.9, k_2 is between about 0.15-0.3 and n_2 is in the range of 1.7-2.0 (col.4, 49-61). Blatchford also teaches that the indices of refraction for the antireflective layers are different, but is silent on the specific index of refraction for the first antireflective layer, n_1 , (for the embodiment where there are three antireflective layers), and does not disclose that the first index of refraction is approximately 2.1. However Blatchford teaches that the indices of

refraction are varied in the three layers by varying the ratio of silane to nitrous oxide during the deposition and are designed to with used with a photoresist layer which is exposed to DUV light in order to avoid destructive interference of the reflected rays, thereby establishing the indices of refraction as result-effective variables. It would have been within the ordinary skill of one in the art to determine the optimal index of refraction for the first antireflection layer in Blatchford by routine experimentation and to have the thickness be approximately 2.1, if required, because Blatchford establishes that the index of refraction is a result-effect variable and the discovery of an optimum value of a result effective variable is ordinary within the skill of the art (*In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)).

6. Claims 40, 42, 44, 45, 47, 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blatchford in view of Fukuda (US 6255151).

1. Blatchford discloses a method for fabricating semiconductor devices in integrated circuits using photolithography. The semiconductor device comprises substrate 10, field oxides 11 (dielectric) of varying topography, metal layer 18 (reflective), antireflection coating 17 and photoresist layer 16. The layer of metal will ultimately be patterned to gate electrodes when the MOSFET device is formed. The

antireflection coating 17 comprises three layers 13, 14, 15 of silicon containing oxides such as silicon oxynitrides, each with different indices of refraction (n) and extinction coefficients or absorptions (k). The antireflection layers are used to eliminate the interference patterns caused by the rays reflected by the underlying topography when the photoresist is exposed (col.1, 18-col.2, 64). Antireflective coating 17 comprising 3 layers with different indices of refraction n and extinction coefficients k are used to eliminate the problem of undesirable interference patterns (col.2, 8-32). When there are three antireflection layers, the first antireflection layer 13 is formed with a thickness of 350-450 angstroms (35-45 nm), while the second antireflection layer 15 is formed with a thickness between 150-250 angstroms (15-25 nm). For the first antireflection layer, k_1 is between about 1.1-1.9 and for the second antireflection layer, k_2 is between about 0.15-0.3. The index of refraction n_2 is in the range of 1.7-2.0 (col.4, 49-61). In order to prevent crosslinking between the photoresist layer 16 and the antireflection coating 17, an additional oxynitride layer 19 (dielectric layer) is formed there between (col.3, 8-15). Layer 13 corresponds to the first anti-reflective layer and layer 15 corresponds to the second anti-reflective layer. Layer 17 is formed of silicon oxynitride which is insulating and therefore corresponds to an insulating layer formed on the second anti-reflective layer.

Blatchford is silent on the specific semiconductor device being formed and does not disclose that the semiconductor device comprises a memory cell comprising at least two active areas, a gate stack between the active areas, and a capacitor in electrical contact with one of the active areas (cl.40), or that the structure is a DRAM cell comprising first, second and third active areas, first and second gate stacks and first and second capacitors, the first gate stack being formed between the first and second active areas, the second gate stack being formed between the second and third active areas, the first capacitor being in electrical contact with the first active area, the second capacitor being in electrical contact with the third active area, and the second active area being in electrical contact with a bit line (cl.44), or that the capacitors are formed over the gate stacks (cl.45), or that the bit line is formed over the capacitors (cl.47).

Fukuda teaches that memory cells of a DRAM are generally placed at points where a plurality of word and bit lines intersect on a principal surface of the semiconductor substrate in matrix form. Each memory cell comprises one memory cell section (MISFET) and one capacitor electrically connected in series therewith. The memory cell selection is formed within an active region, is surrounded by a device separation region and comprises a gate oxide, a gate electrode constructed with each word line, and a source/drain pair. Each bit line is placed at an upper portion of the memory cell and is

electrically connected to one of the source and drain shared by two adjacent memory cells, while the capacitor is also placed in the upper portion and electrically connected to the other of the source and drain (col.1, 14-33). It would have been obvious to one of ordinary skill in the art to have the semiconductor structure in Blatchford to additionally include components such as active regions, gate stacks, capacitors and bit lines, arranged as claimed, because Fukuda teaches that such components in this arrangement are conventional for a memory cell in the art. While Fukuda does not explicitly disclose that there are three active regions that are specifically arranged as claimed in cl.44, the reference does teach that there are a plurality of memory cells and bit and word lines, arranged in series. It would have been within the- ordinary skill of one in the art to determine the exact number of active regions and cells required for the specific device being manufactured because Fukuda teaches that such memory cells and their general structure are known in the art.

7. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Blatchford in view of Fukuda as applied to claim 45 above, and further in view of Chen (US 6140179).

While Blatchford in view of Fukuda teaches capacitors arranged in the memory cell, the references do not disclose that the capacitors are container

capacitors. Chen teaches that crown (or container) capacitors conventional in the art (col.2, 23-27, col.3, 5-6). It would have been obvious to one of ordinary skill in the art to have the capacitor in Blatchford in view of Fukuda be a container capacitor because Chen teaches crown (container) capacitors are conventional in the art.

8. Claim 50 is rejected under 35 U.S.C. 103(a) as being unpatentable over Blatchford in view of Lyons (US 6287959) and Fukuda.

The teachings of Blatchford have been previously discussed. Blatchford discloses a method for fabricating semiconductor devices in integrated circuits using photolithography. The semiconductor device comprises substrate 10, field oxides 11 (dielectric) of varying topography, metal layer 18 (reflective), antireflection coating 17 and photoresist layer 16. The antireflection coating 17 comprises three layers 13, 14, 15 of silicon containing oxides such as silicon oxynitrides, each with different indices of refraction (n) and extinction coefficients or absorptions (k). Layer 13 corresponds to the first anti-reflective layer and layer 15 corresponds to the second anti-reflective layer. Layer 17 is formed of silicon oxynitride which is insulating and therefore corresponds to an insulating layer formed on the second anti-reflective layer. Blatchford does not disclose that the silicon oxynitride antireflective layers

are an etch stop layer. Lyons teaches that silicon oxynitride can be used as both a successful antireflective layer and etch stop (col.2, 34-41, col.4, 42-49). One of ordinary skill in the art would have to expect that the antireflective layers of silicon oxynitride in Blatchford would additionally function as an etch stop layer because Lyons teaches that that silicon oxynitride can be used as both a successful antireflective layer and etch stop.

Blatchford is silent on the specific semiconductor device being formed and does not disclose that the semiconductor device comprises a memory cell comprising at least two active areas, a gate stack between the active areas, and a capacitor in electrical contact with one of the active areas. Fukuda teaches that memory cells of a DRAM are generally placed at points where a plurality of word and bit lines intersect on a principal surface of the semiconductor substrate in matrix form. Each memory cell comprises one memory cell section (MISFET) and one capacitor electrically connected in series therewith. The memory cell selection is formed within an active region, is surrounded by a device separation region and comprises a gate oxide, a gate electrode constructed with each word line, and a source/drain pair. Each bit line is placed at an upper portion of the memory cell and is electrically connected to one of the source and drain shared by two adjacent memory cells, while the capacitor is also placed in the upper portion and

electrically connected to the other of the source and drain (col.1, 14-33). It would have been obvious to one of ordinary skill in the art to have the structure comprising the semiconductor substrate, antireflection layers, dielectric layer and photoresist layer in Blatchford in view of Lyons to additionally include components such as active regions, gate stacks, capacitors and bit lines, arranged as claimed in claim 50 because Fukada teaches that such components in this arrangement are conventional for a memory cell in the art.

Response to Amendment

9. Applicant argues that Blatchford teaches a semiconductor device not an integrated circuit. In claim 1, Blatchford refers to making integrated circuits and the relationship of semiconductors and integrated circuits.

Applicant argues that Blatchford does not disclose or suggest a dielectric formed on the second anti-reflective layer and a metal layer. Layer 15 is formed of silicon oxynitride and may be considered the dielectric layer formed on the second antireflective layer. Blatchford also teaches forming between the photoresist layer 16 and the antireflection coating 17 (layer 13-15), an additional oxynitride layer 19 or dielectric layer (col.3, 8-15). Therefore layer 19 may be considered the dielectric layer for the

embodiment where three antireflective layers are recited in claim 36. Fukuda teaches metal layers in the process of forming semiconductor devices.

Conclusion

10. Any inquiry concerning this communication should be directed to Examiner K. Duda at (571) 272-1383. Official FAX communications should be sent to (571) 273-8300.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff, can be reached at 571-272-1385.

Information regarding the status of an application may be obtained from the Patent Application Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Kathleen Duda
Primary Examiner
Art Unit 1756